

Elements to improve efficiency, cost and quality

The benefits of optimising reliable and accurate glass container inspection with reliable and stable machine handling and line flow at the cold end should not be underestimated by glass container manufacturers. According to Jeffrey David Hartung, consistently stable line flow is critical to the performance of the inspection machine and an integral part of any process control strategy.

The most common misconception about the cold end is that lines need to be run faster to achieve high enough throughput to keep pace with hot end production speeds. In many cases, linear line speeds are actually more than twice as fast as they need to be. This condition usually occurs when poor line flow is present due to stoppages and ware losses that are caused by down ware, ware jam ups and inadequate cold end coating.

To achieve 100% efficiency, the cold end line must be set up so that every container that enters the line is inspected. Achieving this goal does not necessarily mean running the lines at high speeds. In fact, the goal should be to reduce line speed by optimising machine and conveying efficiencies; slow down to run faster.

Today, inspection machine manufacturers must do more than just make good machines. They have to know good container handling, as well as inspection. They need to know both how to reduce line stoppages and how to increase the reliability of the inspection equipment. This does not, however, mean that machine manufacturers like Emhart Glass also need to become conveyor/conveyor control manufacturers. The goal is to understand one and work closely and collaboratively with third parties, while maintaining market leading expertise in the other.

REDUCING LINE STOPPAGES

For years, Emhart Glass has worked with conveyor and conveyor control suppliers. Today, the company is developing even stronger relationships with these suppliers, working with them to enable plug-and-play integration of line control technologies in Emhart Glass inspection systems, as well as pushing the technologies (machines and conveyors) to be more efficient through the use of ware volume

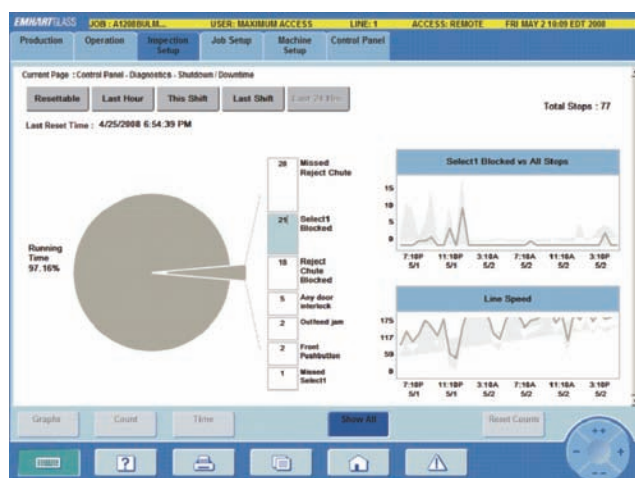


Figure 1: Trend information can be used to improve cold end line flow, as illustrated in this shutdown/downtime screen from an Emhart Glass Veritas machine.

sensors. These volume sensors can monitor production rates and determine the required inspection machine speeds necessary to optimise throughput by ensuring stable ware handling and reliable inspection.

The natural result of line flow improvements is a smoother production line without the backups, backlogs and jams normally associated with cold end inspection lines.

INCREASING INSPECTION EQUIPMENT RELIABILITY

A major factor in glass plant inefficiencies can be attributed to inspection machine reliability. With demanding production and cost saving requirements, the cold end must be able to run 24/7 for long periods, without interruption. One way to achieve smoother line flow and inspection machine reliability is through the growing migration to more non-contact, camera-based inspections. Another is reducing, or eliminating, mechanical parts, as well as specifying and using components that are rated for the harsh environments that are common in glass plants.

ADDING INTELLIGENCE TO INSPECTION MACHINES

Even when all possible steps are taken to optimise ware flow through a production facility, there will always be conditions that occur that may be impossible, or difficult, to control. In these situations, the inspection system must be 'smart' enough to recognise that a problem exists and then needs to relay that information and warning to the line operators. These same tools can also be used to detect potential problems before they become serious enough to cause a line flow interruption. By monitoring ware flow volume, machine cycles and sensor inputs, trending

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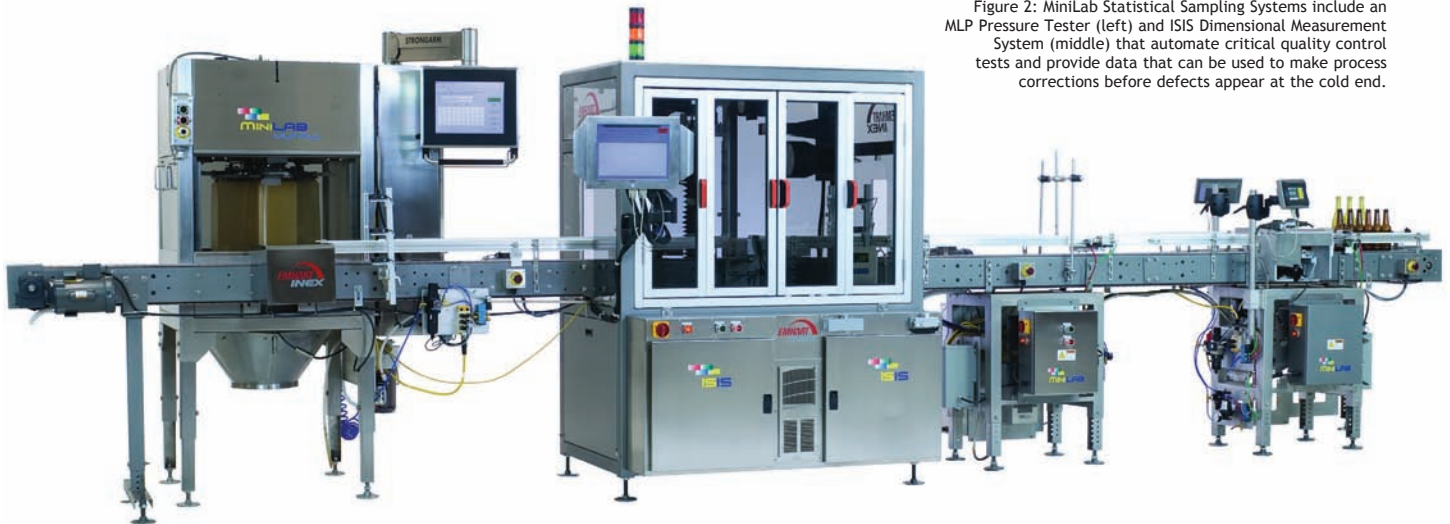


Figure 2: MiniLab Statistical Sampling Systems include an MLP Pressure Tester (left) and ISIS Dimensional Measurement System (middle) that automate critical quality control tests and provide data that can be used to make process corrections before defects appear at the cold end.

tools that are built into the machine software (as illustrated in figure 1) will be able to calculate the actual efficiencies of various mechanical and electronic components. Warning and alarm levels can then be pre-programmed to quickly alert operators to potential problems.

With the use of programmable outputs and stacked multi-warning beacons, several types of alarm indications can be given. No longer

will the machine just indicate that there is a critical condition (normally observed by the fact the ware is no longer flowing). An indicator might also signal that a condition is trending in a negative direction.

A further step in achieving continuous 24/7 operation is the development of systems, such as the Emhart Glass MiniLab Statistical Sampling System (as illustrated in figure 2), that both automates

many of the tasks typically handled by quality control labs and improves the overall reliability of test data. MiniLab devices that can precisely and automatically measure diameter, height, lean, weight, finish profile, capacity and internal pressure strength in a single integrated system can help reduce labour costs two ways. First, tests performed by the MiniLab can be conducted more frequently and more accurately than is possible with manual devices. Second, the MiniLab can alert operators to potential container problems before ware is shipped, thus reducing or virtually eliminating return and reselect costs. >



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FASTER, SMARTER JOB SETUP

Reducing job change time at the cold end is also critical to line efficiency. The cold end must be ready when production starts and workout time must be shortened. The solution is smarter inspection machines that take less time to set up and enable more efficient use of the plant's most skilled technicians.

At the cold end, the mechanical portion of the job change is normally not the most time-consuming part. The real time is lost in inspection setup. Advances in lighting, optics and inspection algorithms are bridging the gap in a machine's ability to discriminate between defects that can be difficult to detect and good ware that may exhibit similar characteristics but are acceptable for commercial use. But this significant improvement in inspection capability should not add time and complexity to job setup. Emhart Glass believes that current and future technologies, many of which are being implemented in the latest inspection devices, will lead to inspection setups that are more automated and self-learning. Using wireless network technologies, simplifying setup parameters and enabling the transfer of setup details across multiple lines, Emhart Glass is now developing systems that will significantly reduce job change time. Reducing job change time also allows more efficient use of skilled technicians, enabling them to design and then replicate high quality inspection setups from one line to another in minutes.

The latest inspection equipment must also incorporate designs that dramatically reduce equipment downtime, one of the most common causes of line flow interruption. The inspection machines of tomorrow will be much more sophisticated and intelligent than the machines of today. Soon-to-be released inspection devices are now starting to incorporate built-in self checks and watch dog systems that monitor subsystems within the machine. For example, by monitoring something as simple as current loads on motors, machines are now able to predict component failures before they actually occur.

CLOSING THE LOOP BETWEEN COLD AND HOT END

Even with all of the improvements in cold end ware flow and inspection reliability, one of the most important aspects to improving overall production efficiency is closing the data loop between cold end inspection and hot end process control. Almost all inspection equipment has the ability to mould-correlate defects. However, more emphasis is being placed on a faster response and better reporting to the hot end.

A key part of this strategy is the use of statistical sampling systems, such as the Emhart Glass MiniLab. On line inspection systems are capable of detecting the defects and reporting mould defect data but as processes start to deviate, these on line devices generally are not able to detect a problem until the process deviation creates a defect. Glassmakers now have the ability to monitor these

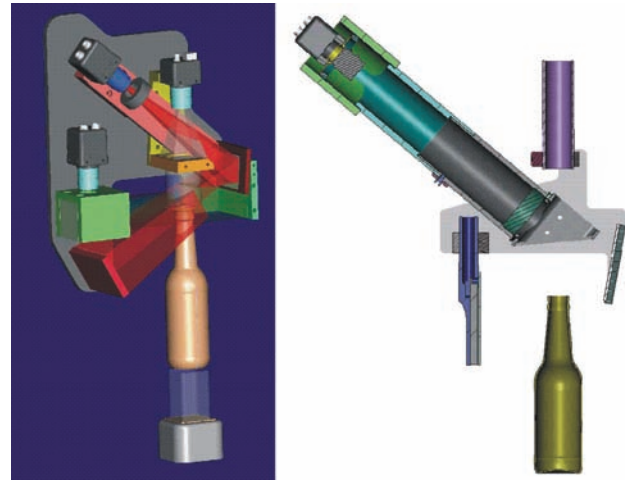


Figure 3: These illustrations of vision dip and plug inspections show how inspection redundancy can help ensure that critical defects do not get into packed ware.

process fluctuations with off line statistical sampling machines, such as the MiniLab. Emhart Glass is also working to further enable on line inspection machines to monitor and track many of the measurable process variables. Together, the MiniLab and the on line inspection equipment become powerful process monitoring tools, thus allowing users to set warning levels and enable the hot end to start making corrections before the defects are ever created.

On line inspection machines are also being improved by making their inspection capabilities more redundant between machines (as illustrated in figure 3). Because of the ever-increasing quality requirements from end users, inspection suppliers will start to build redundancies into the on line machines, providing glass plants with a little insurance that if something happens to one of the filters, the other will be in place to ensure only the highest quality glass gets sent to the end user. Within the FlexInspect product line currently being developed by Emhart Glass, almost all aspects of the container can be inspected by similar, yet different, technologies. For instance, the bore diameter or the overall height of a container will be measured on two separate machines, providing the same results but with different methods.

SUMMARY

Throughout its history, Emhart Glass has built a global reputation for being more than an equipment supplier. A partner to the glass container industry, Emhart Glass has always strived to be a solutions provider. At the cold end, this means that the company must do more than design inspection systems that implement accurate and reliable modern inspection technologies. These inspection devices must be part of a strategy focused on helping glassmakers improve the efficiency of the cold end process – including both inspection and line flow improvements – overall. ■

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